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CLAIMS

Sub B5
1. An apparatus for determining dielectric properties of an electrically conductive liquid, comprising:-

an electrically resonant cavity defined by an electrically conductive boundary wall;

an electrically insulating layer disposed on those parts of the electrically conductive boundary wall defining the interior wall of the cavity;

an inlet through which the fluid can be introduced into the interior of the cavity, said electrically insulating layer isolating the fluid from said electrically conductive boundary wall;

an emitter antenna and associated drive electronics for emitting electromagnetic radiation to the cavity, the emitter antenna being electrically isolated from fluid material within the cavity; and

means for detecting resultant electromagnetic radiation within the cavity.

2. An apparatus as claimed in claim 1 wherein the drive electronics are adapted to operate at a range of frequencies such that a range of frequencies of electromagnetic radiation can be emitted to the cavity.

3. An apparatus as claimed in claim 2, wherein the frequency is continuously variable.

4. An apparatus as claimed in any preceding claim, wherein the antenna for emitting electromagnetic radiation into the fluid material is disposed within the resonant cavity such as to project into the fluid material, the antenna being provided with an insulating layer by which it is electrically isolated from the fluid material

5. An apparatus as claimed in any preceding claim, wherein the boundary of the resonant cavity comprises a conductive wall whose inner surface is covered by said electrically insulating layer by which the wall is electrically isolated from the fluid material within the cavity.

6. An apparatus as claimed in any preceding claim wherein the resonant cavity has an inlet and an outlet such that the fluid material can flow through the

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cavity.

7. An apparatus as claimed in any preceding claim wherein the means for detecting electromagnetic radiation within the cavity comprise a receiver antenna disposed within the resonant cavity and electrically isolated from the fluid material within the cavity.

8. An apparatus as claimed in any of claims 1 to 6 wherein the means for detecting electromagnetic energy within the cavity comprise electronics connected to the emitter antenna for measuring the voltage standing wave ratio.

9. A device for monitoring constituents of a fluid flow comprising an apparatus as claimed in any preceding claim.

10. A device as claimed in claim 9, further comprising measurement electronics for determining the frequency of a resonance peak corresponding to a selected resonant mode within the cavity.

11. A device as claimed in claim 9 or claim 10, further comprising means for measuring additional properties of the fluid flow and calculating means for determining, on the basis of the measured properties, the proportions of certain constituents of the flow.

Sub B5 12. A device as claimed in claim 11, wherein the calculating means operates by calculating for a set of possible permutations of flow constituents the expected values of the measured properties and comparing these with the actual measured values to determine which permutation best matches the measured properties.

13. A device as claimed in claim 12, wherein the calculating means comprise a neural network, trained on experimental data, for determining expected quantities relating to the dielectric properties of the flow corresponding to the permutations of flow constituents.

14. A method of determining dielectric properties of an electrically conductive fluid comprising the steps of disposing the fluid material in or passing the fluid through an apparatus in accordance with claim 1, emitting electromagnetic radiation into the resonant cavity by means of the antenna which is electrically

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isolated from the fluid and detecting and analysing the resultant electromagnetic radiation within the resonant cavity.

15. A method as claimed in claim 14, comprising varying the frequency of the emitted electromagnetic radiation and obtaining an indication of the amplitude of the resultant electromagnetic radiation within the resonant cavity.

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